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**Online self-affirmation increases fruit and vegetable consumption in groups at high-risk
of low intake**

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Abstract

Background: This study tested the efficacy of self-affirmation in promoting fruit and vegetable consumption in a sample of participants comprising two groups at high risk of low consumption: young adults and mothers of school-aged children with low social economic status (SES).

Methods: Baseline fruit and vegetable consumption was recorded for 85 participants ($n = 26$ mothers with low SES). Following randomization to condition (Self-Affirmed or Non-Affirmed), participants viewed targeted, online, health recommendations about fruit and vegetable consumption. Fruit and vegetable intake was reported online every day for the following seven days.

Results: Self-affirmed participants reported consuming significantly more portions of fruit and vegetables, (SA $M = 3.96$, NA $M = 2.81$). Analyses of simple slopes indicated the effect was greatest amongst lowest baseline consumers.

Conclusions: The findings demonstrate the efficacy of self-affirmation in increasing fruit and vegetable consumption in individuals who are at risk of having a low intake and whose consumption put them at the greatest risk of negative health outcomes. Application of these findings could help to reduce health care costs, through the use of cost-effective online interventions and reductions in treatment costs. Further research is needed to capitalize on the increased tailoring that online intervention allows in order to optimize the effects of self-affirmation.

Keywords: self-affirmation; socio-economic status and health; fruit and vegetable consumption; online intervention

The detrimental health effects of low fruit and vegetable consumption are well documented (Marmot, 2007; Peto, 2001). The WHO's recommendation of five 80g portions of fruit and vegetables a day has been adopted by many countries, including the UK and US. Indeed, evidence suggests the greatest health benefits are gained from consumption of upwards of seven portions per day (Oyebode, Gordon-Dseagu, Walker, & Mindell, 2014). Yet recent figures suggest that in the UK only 24% of men and 29% of women achieve the five-a-day target (The NHS Information Centre, Lifestyles Statistics, 2012). In the US adults consume fruits 1.1 times per day and vegetables 1.6 times per day (Centers for Disease Control and Prevention; CDC, 2013).

The Target Groups

There is clearly a pressing need to find ways to encourage people to eat more fruit and vegetables, especially those who currently consume the least. Consequently, this study aims to test the efficacy of an intervention to promote fruit and vegetable consumption in two groups of participants known to be low in their consumption and therefore at heightened risk of the detrimental consequences of low consumption: young adults aged 16 to 24 years and people from low-income households (2014 UK National Diet and Nutrition Survey, NDNS: Public Health England & Food Standards Agency, 2014). In particular, interventions to promote healthier lifestyle choices among socio-economically deprived individuals are much needed (Department of Innovation, Universities and Skills, 2007). For example, having a manual occupation, no educational qualifications, and living in a deprived area, are all independently predictive of lower consumption of fruit and vegetables (Shohaimi, et al., 2004) and young adults aged 16 to 24 years, such as students, also typically have low levels of fruit and vegetable consumption (Li et al., 2011). The intervention combined the presentation of persuasive materials with a self-affirmation induction.

Self-affirmation and Health Behavior Change

Self-affirmation theory (Cohen & Sherman, 2014; Steele, 1988) proposes that people are vigilant to threats to their sense of being competent and morally worthy. Anticipating or experiencing such a “psychological threat” (Cohen & Sherman, 2014, p. 334) can induce defensive responding. Researchers (e.g., Harris & Epton, 2009) have postulated that health-risk information can pose such a threat and thereby induce defensiveness. This may account for the tendency among the targeted audience to display “resistance” to messages encouraging health-behavior change, such as messages advocating the consumption of sufficient fruit and vegetables.

However, affirming an important, unrelated aspect of the self has been shown to reduce resistance and enhance the uptake of strong messages, including effects on health behavior (e.g., Cooke, Trebaczyk, Harris & Wright, 2014; Epton & Harris, 2008; Jessop, Sparks, Buckland, Harris & Churchill, 2014; van Koningsbruggen et al., 2014). Of particular relevance to the current study, Epton and Harris (2008) demonstrated that self-affirmation increased fruit and vegetable consumption over seven days following the experiment (see also Harris et al., 2014). Indeed, a recent meta-analysis (Epton, Harris, Kane, van Koningsbruggen & Sheeran, 2014; see also Sweeny & Moyer, 2015) focused on the effects of self-affirmation at three key points in the behavior change process: message acceptance, intentions to change and subsequent behavior, finding significant positive effects of self-affirmation at all three (message acceptance $d_+ = .17$; intentions $d_+ = .14$; behavior $d_+ = .32$).

There is also evidence that the effects of self-affirmation can be most pronounced among high-risk individuals. For example, in a study targeting alcohol, Harris and Napper (2005) found that the impact of self-affirmation on outcomes (e.g., negative affect, intentions, imagination and risk) was greatest among those who drank the most. Similarly, Armitage et al. (2008) found that the impact of self-affirmation on intentions and message acceptance was higher in moderate smokers than light smokers, and Van Koningsbruggen and Das (2009)

showed that self-affirmation reduced message derogation, raised intentions and increased the likelihood participants would click on a link to an online diabetes test among higher risk participants.

However, to date self-affirmation studies have employed a relatively limited range of health-information materials and, in particular, these have tended to be brief and not targeted to the needs of a particular group. Yet targeted health-interventions i.e., intervention materials with features that the targeted population subgroup members prefer (Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2002), have been shown to have benefits over untargeted information in terms of encouraging interest in health-behavior change.

The Internet

The Internet provides the basis for low cost, far-reaching, timely intervention (Griffiths, Lindenmeyer, Powell, Lowe & Thorogood, 2006). Self-affirmation is a promising technique to employ in online interventions, as it is a low-cost technique that can easily be combined with health related information, but to date self-affirmation studies have used relatively minimal message materials in terms of scope and content (Epton et al., 2014). In the current study the websites were developed following discussions with target users to help promote the efficacy of the intervention (Bennet & Glasgow, 2009). In this case targeting involved making recommendations suitable for each group alongside the use of images depicting individuals the participants could identify with. In addition, the language and terminology used suited the preferences expressed by the groups in pilot work.

In sum, the current study extends previous research in two ways. First, by testing whether (a) self-affirmation can be effective in promoting fruit and vegetable consumption amongst individuals identified as being at high-risk and (b) the effects of self-affirmation are greatest in individuals whose baseline fruit and vegetable consumption is lowest. Second, the self-affirmation was combined with online health information presented on websites targeted for the target groups.

Method

Participants

A purposive sample of 85 participants was recruited (see Figure 1 for participant flow through the study), consisting of mothers with low SES and young adults recruited from (blank for review) University. The low SES mothers ($n=26$) were recruited through Sunderland Children's Centres. These centres run groups specifically for parents with low SES in order to provide them with support in terms of skill development. Attending these sessions signified the parents have low SES, which was corroborated by the English Indices of Deprivation (Neighbourhood Renewal Unit, 2004) and occupation data. The mothers were reimbursed for their time with a £5 shopping voucher.

Female university students ($n = 59$) were recruited through University's Psychology Department's research participation pool and took part in exchange for course credits. Full ethical approval was received from (blank for review) Ethics Committee. Complete data were available for 72 of the participants, $n = 24$ mothers with low SES (M age = 32.4, $SD = 6.3$ years) and $n = 48$ young adults (M age = 21.6, $SD = 3.2$ years) (see Figure 1). Of the 13 participants who did not complete the study, 5 failed to log on to complete any of the online diary entries after completing the initial phase of the study. The remaining 8 dropped out over the course of the seven-day follow up.

Materials

An online questionnaire was designed to deliver the measures and study information to the participants. The websites presenting the health message concerning fruit and vegetable consumption were developed to be distinctly different and appropriately designed for each target group. The additional measures were all adapted from Epton and Harris (2008), with the exception of baseline and post-manipulation fruit and vegetable consumption, which were measured using a 24 hour recall method (Block, 1982; Karvetti & Knuts, 1985).

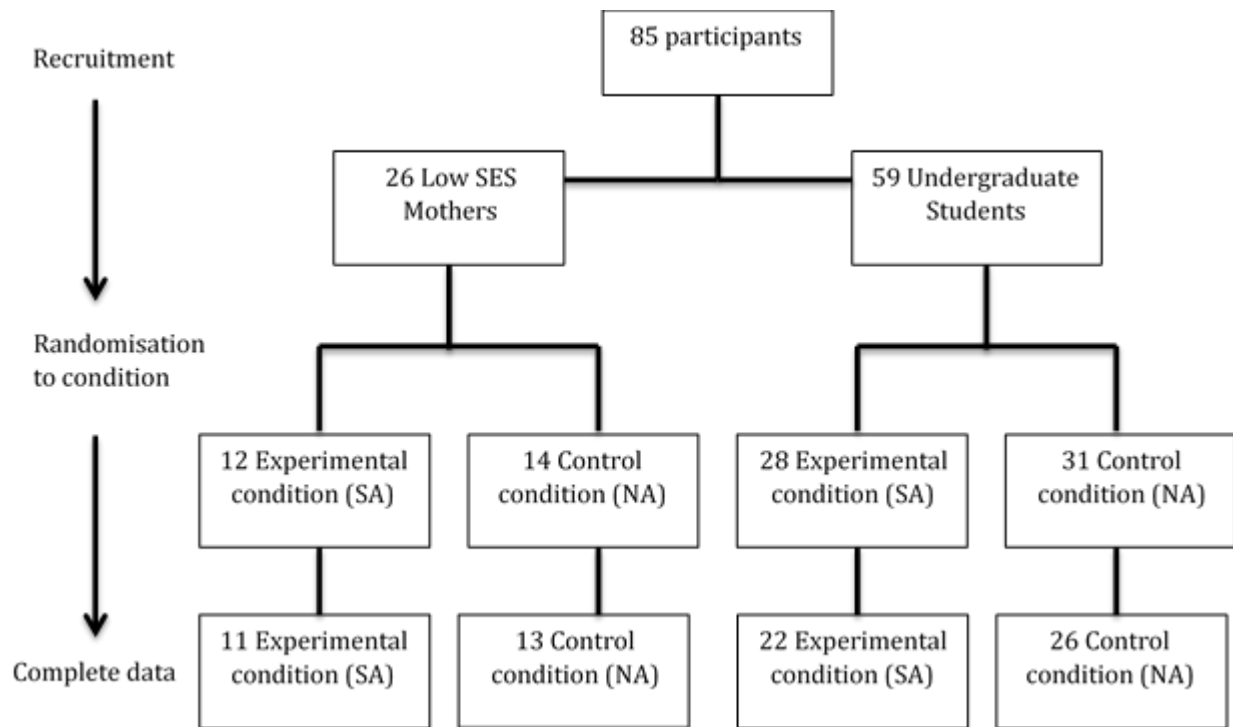


Figure 1 Prisma flowchart of participants through the study

Baseline measure.

Pre-manipulation behavior measure.

Baseline measures were taken of current fruit and vegetable consumption. The online questionnaire, developed in consultation with a registered public health nutritionist, asked participants to record their dietary intake, both food and drink, for the last 24 hours and to confirm that the last 24 hours was typical. Block (1982) and Karvetti and Knuts (1985) have shown that 24-hour recall is a valid method for assessing a group's dietary intake, when coupled with a question to assess if the previous 24-hours reflected normal dietary behaviors. Participants were asked to identify any elements of their intake that constituted a portion of either fruit or vegetables. To facilitate this participants were also provided with guidance as to what constituted a portion of fruit or vegetables based on the premise that one portion is approximately 80g.

Intervention.

To replicate Epton and Harris (2008) the self-affirmation manipulation and the control group task, a personal opinions questionnaire, were adopted from Reed and Aspinwall (1998). The self-affirmation manipulation posed a series of questions such as; *“Have you ever forgiven another person when they hurt you”*. When participants gave a ‘yes’ answer they were asked to type an account of this experience. The personal opinion questions involved a series of questions designed to follow the same format as the self-affirmation questions but to elicit only the participants’ opinions on a range of arbitrary subjects. *“I think chocolate is the best flavor of ice cream”*. When answering ‘yes’ they were asked to explain why.

The websites presenting the health message.

The websites were designed to be visually appealing, credible, expert and trustworthy (Harris et al., 2011) in the eyes of the two target groups. An earlier interview-based pilot study had identified key preferences for the target groups with respect to the presentation of information and the use of relevant images. Young adults, for example, showed a preference for information backed up by research evidence, whereas the mothers with low SES disliked scientific terminology. The findings of the pilot study were used to inform the look and functionality of the website and the behavioral recommendations provided on the sites (see Fielden, 2012 for a detailed discussion). The websites consisted of 7 pages of information (see screenshots in Figure 2) based on the same central message derived from UK government websites relating to eating ‘five a day’ as developed by Epton and Harris (2008).

Health Information Processing and Personality
When you have looked at all the pages on the website click the 'Finish' button to return to the questionnaire.
The finish button will not be active until you have read all the pages including the read more options.

5·A·DAY:

HEALTHY BODY | HOW IT WORKS | FRUIT AND VEG CONSUMPTION | FURTHER INFORMATION



Research suggests that by eating more fruits and vegetables the condition of your skin and hair will improve

INTRODUCTION

Health professionals, from around the world, currently recommend eating a minimum of 5 portions of a variety of fruit and vegetables per day to help prevent diseases and promote a healthy body. These recommendations can benefit everyone regardless of age or gender.

As a student it can be hard to ensure you consume enough fruit and vegetables. Time, money and shared cooking facilities eaters can all make it difficult to eat enough fruit and vegetables.

On this site you will find information about why eating at least 5 portions of fruit and vegetables a day is so important.

You will also find information about what counts as a portion and tips for how you can fit more portions into your diet.

Cooking together with your housemates and splitting the cost of shopping can help to ensure you and your friends all get more fruits and vegetables into your diet.

By eating more fruits and vegetables as part of a healthy lifestyle you won't just see benefits in your health, research suggests you will have increased energy, have improved concentration and the condition of your skin and hair will also improve.

PREVENTION OF DISEASES



Studies suggest that increasing the amount fruit and vegetables you eat can significantly reduce the risk of many chronic diseases.

[READ MORE...](#)

RECOMMENDATIONS



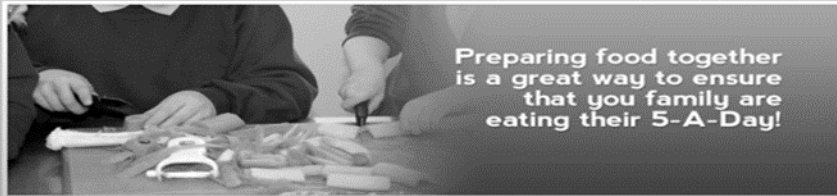
To receive the beneficial health effects from increased fruit and vegetable consumption, at least 5 different portions of a variety of fruit and vegetables (excluding potatoes and nuts) should be consumed daily.

[READ MORE...](#)

Health Information Processing and Personality
When you have looked at all the pages on the website click the 'Finish' button to return to the questionnaire.
The finish button will not be active until you have read all the pages including the read more options.

FIVE A DAY

HEALTHY BODY | HOW IT WORKS | FRUIT AND VEG CONSUMPTION | FURTHER INFORMATION



Preparing food together is a great way to ensure that you family are eating their 5-A-Day!

INTRODUCTION

Health professionals, from around the world, currently recommend eating a minimum of 5 portions of a variety of fruit and vegetables per day to help prevent diseases and promote a healthy body. These recommendations can benefit everyone regardless of age or gender.

As a parent it can be hard to ensure you and your family consume enough fruit and vegetables. Time, money and fussy eaters can all make it difficult to get your family eating enough fruit and vegetables.

On this site you will find information about why eating at least 5 portions of fruit and vegetables a day is so important. You will also find information about what counts as a portion and tips for how you can fit more portions into your diet.

Don't forget that as a parent it is important that your children see you eating and enjoying fruits and vegetables too!

Not only will you see the benefits for your own health, but also you will be setting a positive example to your children.

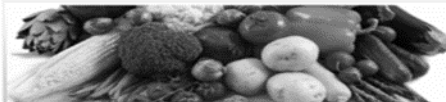
PREVENTION OF DISEASES



Studies suggest that increasing the amount fruit and vegetables you eat can significantly reduce the risk of many chronic diseases.

[READ MORE...](#)

RECOMMENDATIONS



To receive the beneficial health effects from increased fruit and vegetable consumption, at least 5 different portions of a variety of fruit and vegetables (excluding potatoes and nuts) should be consumed daily.

[READ MORE...](#)

Figure 2 Illustrative examples of the websites used in the study. On the left the home page aimed at the mothers with low SES, on the right the home page aimed at students.

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Post-manipulation Measures.

Manipulation Check:

A manipulation check (Napper, Harris & Epton, 2009) was included to assess whether participants in the experimental condition had self-affirmed. The check consisted of six items in total. The first four were semantic differential scales e.g. “the paragraph I wrote earlier made me think about things I like about myself – things I don’t like about myself” on a 7 point scale and two items e.g. “the paragraph I wrote earlier made me aware of who I am” measured on a 5 point scale (strongly disagree to strongly agree). As the scales for responses to these questions differed, z scores were calculated to compute final manipulation check scores.

Post-manipulation behavior measure:

Participants received a unique user ID code during the study and this was automatically sent to them by e-mail to preserve their anonymity. They were instructed (and reminded by a daily e-mail) to log on to a website every day for the following seven days. They were asked to record everything they had eaten and drunk in the previous 24 hours. They were provided with guidance as to what constituted portions of a variety fruits or vegetables, and were subsequently asked to identify how many portions or part portions they had consumed.

Procedure

Testing sessions were arranged in a quiet room at a local community center for the mothers with low SES, whilst the young adult participants were asked to attend a testing session at the University. Participants were informed that they were taking part in a series of studies looking at the communication of health information online, personality and beliefs. Consent and briefing information was delivered via the online questionnaire, participants received their unique ID on providing informed consent. Having completed the online

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baseline fruit and vegetable measure, participants were randomly assigned to either the experimental (self-affirmation manipulation) or control condition (personal opinions questionnaire). On completing these measures the online questionnaire directed the participants to the relevant, targeted website. Once they had read the information on the website the participants returned to the online questionnaire and completed the post manipulation measures. Participants were asked to record their daily intake as described previously. On completion of the seven-day diary participants were presented with debrief information.

Results

Randomization to condition and manipulation check.

Participants in the experimental (self-affirmed) and control (non-affirmed) conditions did not differ significantly in baseline fruit and vegetable consumption, $t(1, 70) = 1.61, p = .111$. There was a significant difference between groups on the manipulation check scores, $t(1, 70) = -9.27, p < .001$, with those in the experimental group having higher scores (Table 1).

Table 1 Descriptive statistics of baseline fruit and vegetable consumption and manipulation check (z scores) between the conditions for all participants and the sub-group of Low SES Mothers

	Baseline fruit and vegetable consumption		Manipulation check scores (z scores)	
	SA Mean (SD)	NA Mean (SD)	SA Mean (SD)	NA Mean (SD)
All Participants	2.52 (1.46)	3.10 (1.60)	.5862 (.51)	-.496 (.48)
Low SES Mothers	2.00 (.78)	2.92 (1.71)	.5369 (.48)	-.5255 (.36)

Effects of self-affirmation on fruit and vegetable consumption.

To determine the effects of self-affirmation on post-manipulation behavior, a mixed 2 x 7 analysis of co-variance (ANCOVA), with condition (self-affirmed or non-affirmed) as the between subjects variable and day (seven days) as the within subjects variable, and baseline

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consumption as the covariate, was conducted. The analysis revealed a significant main effect of condition, $F(1, 69) = 49.47, p < .001, \eta_p^2 = .42$, (see Figure 3). Self-affirmed (SA) participants reported consuming significantly more fruit and vegetables than non-affirmed (NA) participants (SA $M = 3.96, SD = 0.79$; NA $M = 2.81, SD = 1.3$). The main effect of condition was not qualified by a significant interaction with day $F(6, 64) = 1.70, p = .135$. There was no significant main effect of day overall, $F(6, 64) = 1.11, p = .364$. The effect of the covariate, baseline fruit and vegetable consumption, on mean post-manipulation consumption was significant, $F(1, 69) = 49.47, p < .001$.

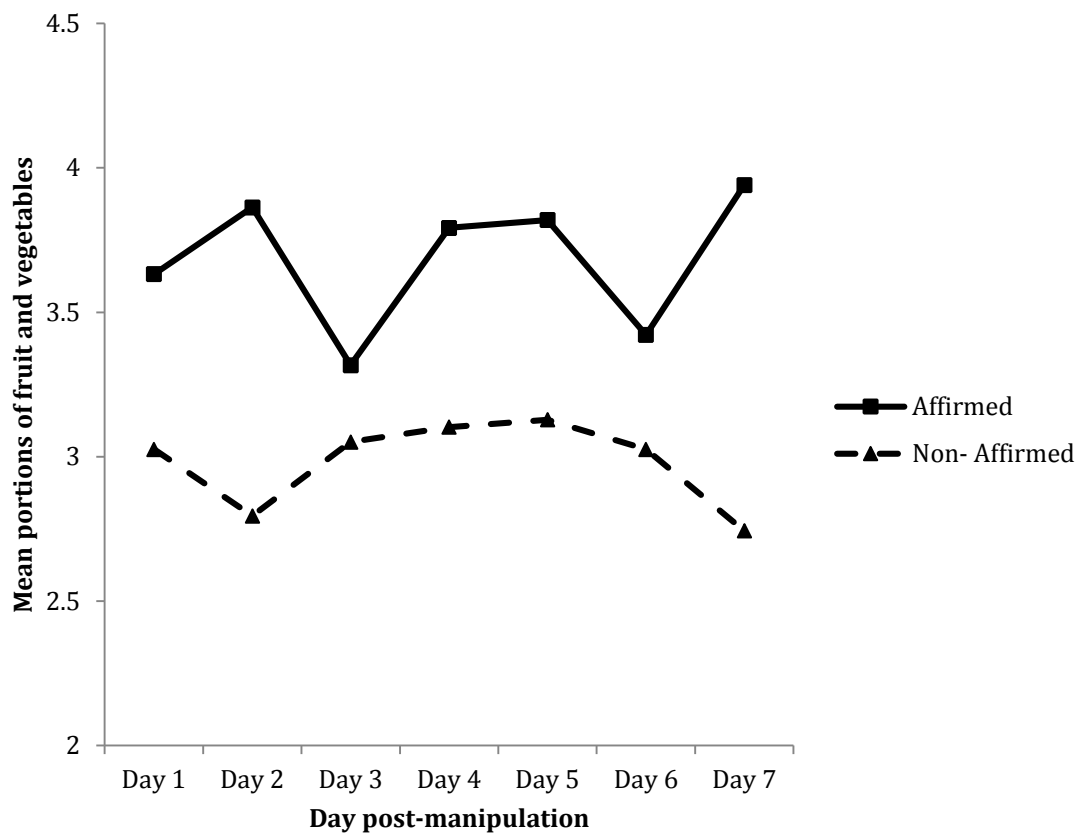


Figure 3 Reported fruit and vegetable consumption in the 7 days post manipulation by condition

The effects of self-affirmation determined by consumption level at baseline.

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We explored the prediction that self-affirmation would lead to a greater increase in fruit and vegetable consumption among individuals with lower baseline consumption using regression analyses. These revealed a significant interaction between condition (self-affirmed or non affirmed) and baseline consumption on post manipulation fruit and vegetable consumption ($\beta = -.15$, $SE = .05$, $p = .004$). Inspection of simple slopes (Aiken & West, 1991) indicated that at lower levels of baseline fruit and vegetable consumption (entered as -1 standard deviation; $\beta = 2.45$, $SE = .11$, $p < .001$), self-affirmation led to greater increases in post manipulation consumption than higher levels (+1 standard deviation); $\beta = 4.27$, $SE = .12$, $p < .001$, of baseline consumption (see Figure 4).

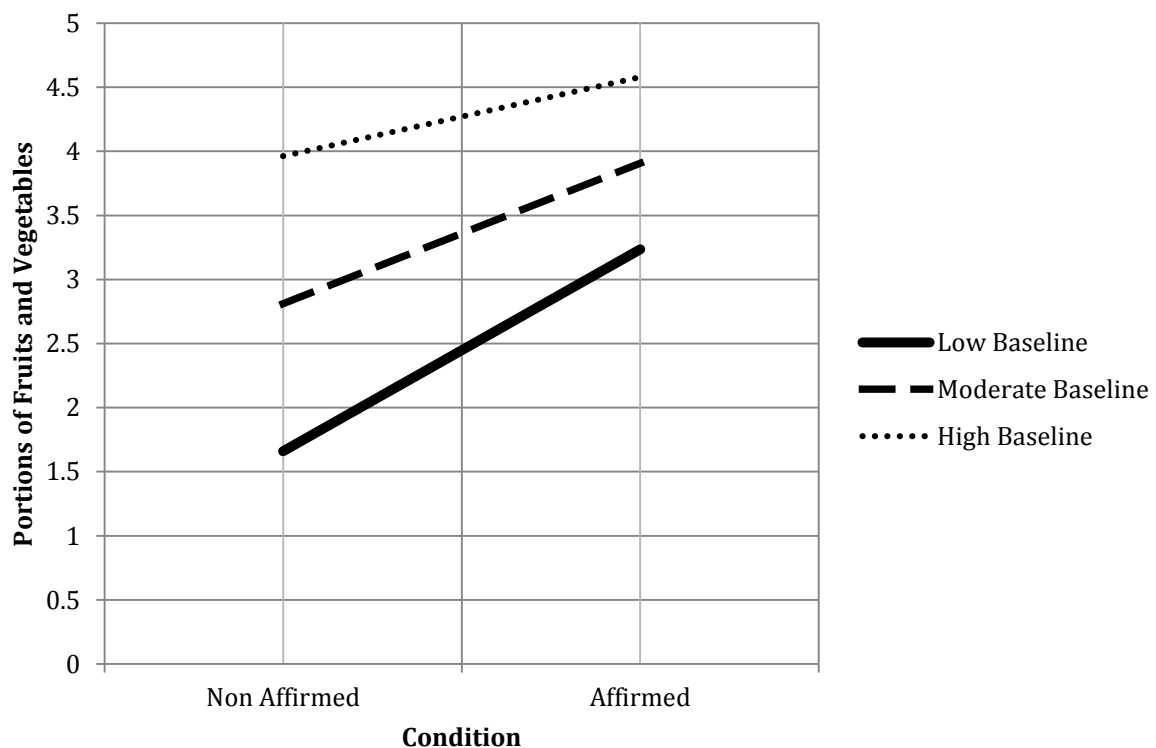


Figure 4 Simple slopes for the interaction between condition and baseline fruit and vegetable consumption on fruit and vegetable consumption at 1 week follow-up; simple slopes have been calculated at mean (moderate consumption), +1 standard deviation (higher consumption), and -1 standard deviation (lower consumption) levels of baseline consumption

Effects of Self-affirmation on Behavior in Mothers with Low SES

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We also undertook a set of analyses of the responses of the mothers with low SES to determine whether these were distinctive. A significant main effect of condition on behavior was revealed among these mothers, $F(1, 21) = 19.17, p < .001$. Self-affirmed mothers with low SES reported consuming significantly more fruit and vegetables than non-affirmed participants (SA $M = 3.98$, NA $M = 2.79$) (Figure 5). There was no main effect of day, $F(6, 126) = 1.69, p = .130$. In this case there was also a significant interaction with day, $F(6, 126) = 2.54, p = .024$ (see Figure 5). To unpack this, separate within-subjects ANOVAs were run within the two conditions testing the effect of day. There was no significant effect of day for self-affirmed participants, $F(6, 60) = .165, p = .983$; however the effect of day was significant among the non-affirmed participants $F(6, 72) = 3.47, p = .005$.

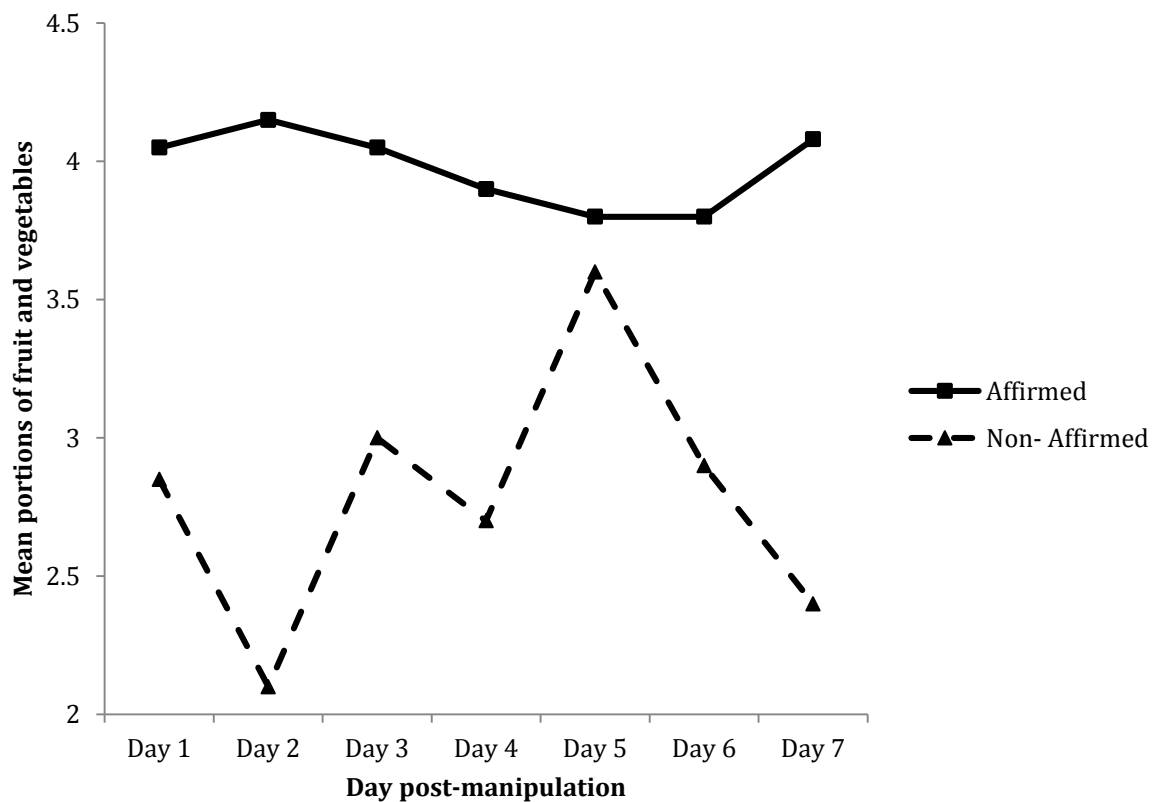


Figure 5 Reported fruit and vegetable consumption in the 7 days post manipulation by condition for low SES mothers

Discussion

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This study tested the effectiveness of a self-affirmation technique combined with an online intervention to increase the fruit and vegetable consumption in two groups of at-risk participants, young adults and mothers with low SES.

Self-affirmed participants reported higher consumption of fruit and vegetables than their non-affirmed counterparts in the 7 days following the experimental manipulation. This effect was mostly consistent over the 7 days. Self-affirmed participants reported eating on average nearly 4 portions of fruit and vegetables a day whereas the average consumption of non-affirmed participants was fewer than 3 portions daily. Relative to those in the control condition, self-affirmed participants reported consuming 8 more portions of fruit and vegetables over the week, or just over one extra portion a day. Although self-affirmed participants in this study did not meet the ‘5-a-day’ target, the increase observed is still a significant one: research indicates that an increase in just one portion a day can lead to a 4% reduction in the risk for CHD and a 6% reduction in the risk for stroke (Joshipura et al., 2001).

This study also demonstrated that participants whose baseline consumption was amongst the lowest benefitted most from the self-affirmation manipulation and showed the greatest increase in their fruit and vegetable consumption. These findings contribute to our knowledge about the potential for self-affirmation to effect a change in behavior, particularly in instances where it is needed most. Targeting hard to change groups using online interventions has important implications for developing low-cost, high impact interventions. This study also highlights the importance of including the target groups in the development of online interventions to ensure the material is viewed as credible as well as conveying appropriate recommendations.

The data from the mothers with low SES demonstrated behavior change consistent with that observed for the whole group. This is a very positive finding and suggests this

ONLINE SELF-AFFIRMATION INCREASES FRUIT AND VEG

technique has the potential to effect change in a group of high-risk individuals. In this case, however, the difference between the two groups did fluctuate daily, resulting in a significant day x condition interaction. Self-affirmed participants' consumption was maintained at a mostly consistent level over the seven days, but the non-affirmed participants' consumption fluctuated. It is noteworthy that consumption levels on day 5 were, however, similar in both conditions: the mothers all entered the study on a Tuesday, so that day 5 was a Sunday. It is possible that the participants in the non-affirmed group consumed more fruit and vegetables on this day than on the other days of the week as a traditional English Sunday lunch is typically served with 2 or 3 different vegetables.

Study Implications and Limitations

This study replicated the findings of Epton and Harris (2008) and, more recently, those of Harris et al. (2014) and van Koningsbruggen et al. (2014). Self-affirmation led to a significant, measurable change in fruit and vegetable consumption. It provides further evidence that effects of self-affirmation on behavior can be most pronounced in individuals whose baseline behavior puts them most at risk. This in itself is a significant finding, primarily because it is usually those whose behavior puts them most at-risk from negative health outcomes that are the hardest to persuade (Good & Abraham, 2007). What is more, the study has demonstrated the potential for a low-cost online intervention to be successful in a group of individuals whose low SES status puts them at a heightened risk of developing diseases as a consequence of their lifestyle.

The study has several limitations. The effects of self-affirmation on the behavior of mothers with low SES require replication with a larger sample. In line with previous studies, this study used a self-report measure of participants' behavior. As with any self-report measure, there is always the possibility that the effect of an experimental manipulation is evident in the reporting of the behavior rather than in the behavior itself, thus more objective

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measures of behavior are needed in future studies. Furthermore the study reported here required participants to attend an initial testing session where they completed the first phase of the study. For a greater understanding of the efficacy of online self-affirmation manipulations in a real world setting, the study should be evaluated with all components delivered at a distance, online.

Bennett and Glasgow (2009) note that the potential for technologies to compile large amounts of user data provides a valuable resource to tailor health messages to the specific needs of an individual. Tailoring information, rather than targeting, may result in an even more persuasive message (Kreuter et al., 2002) and will help to capitalize on the benefits and reduced costs associated with online interventions (Griffiths et al., 2006). Researchers should look to profit from this and design health messages based on the specific requirements of the individual, which may bolster the effectiveness of self-affirmation manipulations leading to greater changes in behavior.

The study reported here had a 7 day follow up period. Research is beginning to demonstrate that self-affirmation manipulations may have effects that persist over even longer time periods. For example, Harris et al. (2014) found effects at 3 month follow up in relation to fruit and vegetable consumption. Cohen and Sherman (2014) and Wileman et al. (2014) have demonstrated effects of self-affirmation on behavioral outcomes at 6 months and beyond. Therefore future research needs to continue to incorporate extended follow up periods to establish the potential for online self-affirmation to lead to sustained changes in behavior, particularly among those most at risk.

In conclusion the findings demonstrate the efficacy of self-affirmation in increasing fruit and vegetable consumption in individuals who are at risk of having a low intake and those whose baseline consumption puts them at the greatest risk of the negative effects of low intake. Self-affirming online has the potential to reduce health care cost by reducing

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dissemination and delivery costs and through the prevention of future ill health. Further research is needed to capitalize on this in order to optimize the effects of self-affirmation.

ONLINE SELF-AFFIRMATION INCREASES FRUIT AND VEG

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